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Supply Chain Management: Moderating Effect of COVID-19 on the Relationship of Logistics Performance and Supply Chain Resilience

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Abstract

The aim of the study is to examine the correlation between Logistic performance and Supply Chain resilience and with COVID-19 as moderator. Quantitative research was conducted for this study which questionnaire was adapted from (World Bank LPI_2018_Questionaitre) 12 number of respondents were responded on the closed ended questionnaire. The theory of constraint, the strength of the supply chain link that can dictate the effectiveness and efficiency of the supply chain partnership and the ultimate success of the supply chain. According to the results, positive relationship exists between the Logistics performance and Supply Chain Resilience. A very weakening effect was observed on COVID-19 pandemic as moderator. The results of hypothesis indicated that H1 Logistics performance index plays a substantial role in enhancing the supply chain resilience and H2 Covid-19 significantly moderates relationship of logistics performance index and supply chain resilience.

Keywords: logistics performance index, Covid-19, pandemic, epidemic, supply chain resilience

Introduction

Disturbances in Supply can happen, attributable to human made catastrophes and act of Mother Nature calamities. All around the world, many cases have happened in the past, like in 2011 the Japan tsunami (Gou & Lam, 2019). Corona virus pandemic has seriously affected almost every sector (Chamola et al., 2020). Originated from Wuhan City's Market, China in December 2019 (Rothan & Byrareddy, 2020), later it was named as COVID-19.

Observing the effect of eccentric and uncontrolled disease within excess of 118,000 cases in 114 nations over the world, the WHO assigned this

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infection as a COVID-19 Pandemic on 11 March 2020 (WHO, 2020). Till the date (June 15, 2020) 435,600 individuals have passed on everywhere on the globe, and it might likewise accept a lot more lives as 7.9 million individuals have tried positive and continuous development has been seen in the quantity of contaminations of COVID-19. In India, COVID-19 cases have reached at 368,705 in the third week of June 2020 (Dong, Du, and Gardner 2020). Increasing cases cause tremendous tension on the medical services Supply chain for a pressing need of individual protective equipment, masks, and drugs (Iyengar et al., 2020).

In recent research the significance of supply chain resilience (SCRES) has been underscored to endure any unfriendly impact of unwanted incidents (Brandon-Jones et al., 2014; Carvalho et al., 2012). Knowing that not all the incidents are avoidable, hence this reasons SCRES (Hohenstein et al., 2015; Jüttner & Maklan, 2011), however by developing resilience, firms can effectively deal with the impacts of any disruption of their supply chain (Kim et al., 2015; Scholten et al., 2014). Most of the researchers concur that this is more relevant to the preparation of a supply chain's compelling reaction to recuperation from any form of disturbance, bouncing back to the origin level or most ideal, a far and away towards a superior degree of operational execution (Hohenstein et al., 2015; Tukamuhabwa et al., 2015). SCRES is a significant theme in the tasks and supply chain management literature that needs more exploration (Ambulkar et al., 2015; Hohenstein et al., 2015; Kim et al., 2015; Scholten et al., 2014) Knowingly that the third world nations constitute a significant portion of worldwide supply chain, as well as the share in the world's population. They have also encountered overwhelming impacts owing to disruptions and resulting in supply chain failures (Chika et al., 2011). This subsequently highlights that fact to be seriously concerned about creating world supply chains that are resilient, in a universally associated world (Kim et al., 2015; Levalle & Nof, 2015; Pereira et al., 2014) while others contend that these are interconnected (Johnson et al., 2013; Jüttner & Maklan, 2011).

LPI as a measure the logistics performance of a country or a firm and relate logistics performance to its trade and commuting strategy. Numerous different examinations utilized LPI as score on various segments of business study exploration reasons. Hoekman and Nicita (2011) inspect major

reports of the World Bank with respect to trade limitations and applied them to developing nations. LPI is utilized like an indicator of logistic performance which could be considered to assess certain impacts. The authors discovered that to build trade, it makes more advantageous sense to actualize strategy that quantifies that influence the LPI scores than to apply other or different measures.

Problem at Hand

COVID-19 impacted the world and severely disrupted way of our lives substantially. The pandemic halted all social and economic activities that touch our lives daily (Johnson et al., 2013). Supply chain is a complex network and logistics system is more critical to manage. This study signifies the strength of supply chain lies in its core domain logistics. Almost all human necessities during pandemics were relied on logistics; the mobility of foods and basics got hindered which called for a resilient supply chain network. The study suggested the horizon in how to improve logistics performance and increase agility to strengthen the supply chain and bring resilience.

Objectives of the Study

1- To investigate the effects of logistics performance index on the supply chain resilience.

2- To investigate the moderating effects of Covid-19 on the relationship between the logistics performance and supply chain resilience.

Hypothesis of the Study

H1: Logistics performance index plays a substantial role in enhancing the supply chain resilience.

H2: Covid-19 significantly moderates relationship of logistics performance index and supply chain resilience.

Conceptual Framework
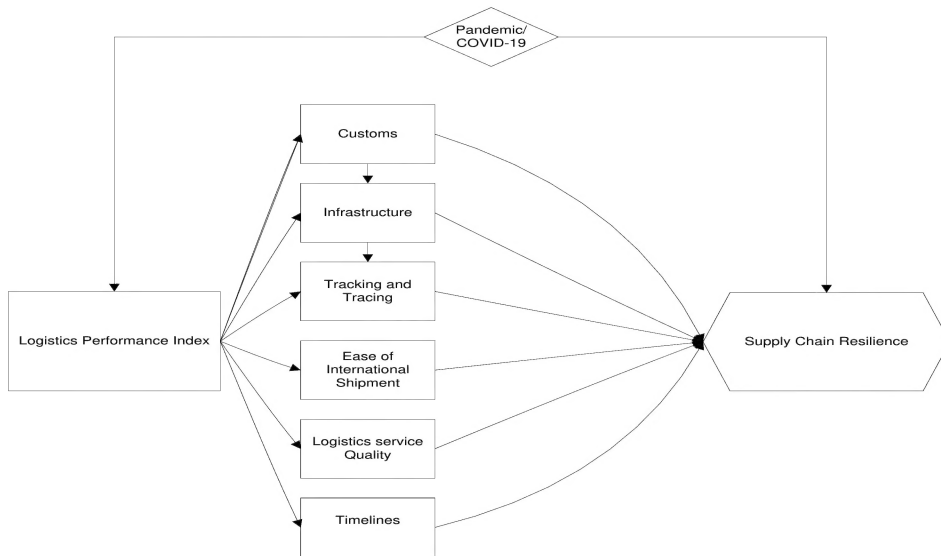
Literature Review

Supply Chain Management

Supply chain management has become strategic level thing these days for improvement of organizational effectiveness in attaining organizational goals like competitiveness, excelling customer service and profitability increase (Gunasekaran et al., 2001). In addition to the other aspects of chain management, green, leaner and resilience is viewed as basic to supply chain performance (Azevedo et al., 2008; Carvalho et al., 2012). In the current global economy stage where supply chains crossover nations and landmasses, the danger of primitive and unforeseen occasions is higher than before; this potentially can make the scope of interruptions and disruptions much huge. These interruptions are then spread throughout the value system of supply chain, causing server impacts in all accomplices (Zsidisin et al., 2005). It appears to be that what can be acceptable from the competitive perspective, however organizations must act to be resilient and robust in order to sustain their competitiveness (Carvalho et al., 2012). In current times the marketplace is portrayed by elevated levels of choppiness and instability. Subsequently leaving supply chains more helpless against these

interruptions, resulting the danger of business progression (Azevedo et al., 2008). Earlier, the supply chains configured over the prime target of cost minimization or service enhancement, but now emphases on its resilience (Tang, 2006). Resilient supply chains theoretically may not be the least cost supply chain but yet they are agile in adapting to the vulnerability of business climate. Resilience caters adaptability of the supply chain and counter to any unforeseen or potential aggravations. In any supply chain system, responding proficiently to any disruptions is the goal (Zobel, 2011). The target of resilient methodologies has manifolds (Haimes, 2006): (1) to recuperate ideal of the condition of the disrupted system in a satisfactory timeline and at efficient expense; and (2) diminishing the viability of the unsettling influence by improvising the degree of an expected danger.

Leading stakeholders from any supply chain are liable to build resilience within and add strength to the whole system (Gölgeci & Ponomarov, 2015; Kamalahmadi & Parast, 2016). Since supply chain encompassing all business systems (Tukamuhabwa et al., 2015), individual's resilience can change into SCR (Sheffi & Rice Jr, 2005). Although, organizations should be set up ahead of time for the control of epidemic outbreaks. This means that they ought to have set up strong alternate courses of action tending to issues like the accessibility of emergency stocks and very much prepared work force, their proper deployment, the accessibility of various kinds of vehicles for the logistics of basic clinical supplies and items and so forth By and large, it stays exceptionally hard to characterize whether the requirements for delivering and circulating of provisions on account of conceivable pandemic can be met (Fedson, 2003; Webby & Webster, 2003) by existing limits. Subsequently, any endeavor to contain pandemic outbreak requests continuous arrangements that should guarantee the viable administration of all the logistics activities occurring, since some of the time these exercises may turn into a genuine bad dream if not for see appropriately (Osterholm, 2001).

The outburst Corona Virus Disease 2019 (COVID-19) a known contagious illness, has brought a worldwide misfortune to all walks of life, severely impacting economic actions like manufacturing, services, transport, logistics or other associated (Dolgui et al., 2020; Golan et al., 2020; Haren & Simchi-Levi., 2020; Hobbs, 2020; Iyengar et al., 2020; T

Linton & B Vakil, 2020; Remko, 2020). Because of which lockdowns were enforced during March and April 2020 in a many part of the world to control the possible fatalities and physical health loss it may bring. Around 2.6 billion individuals were home isolated during the same (Laurent, 2020). Lockdowns resulted in lack of workforce and severely disrupted the logistics, resulting in supply stuns. In addition to this it kicked quick hike of food demand as impulse purchasing and storing behavior of the people in such a panic (Hobbs, 2020). The lockdown seriously handicapped every activity and brought the world at a sudden stop situation. In the current times of globalization where business entities are integrated through intervening arrangements of supply chains and logistics, hardly corrective exercises proved successful during the COVID-19 pandemic. Financial activities globally hit the absolute bottom and the downturn worldwide initiated monetary emergency anticipated by World Bank, WEF, and IMF(Lucchese & Pianta, 2020). Observed adverse impacts of the COVID-19 on supply chain and manufacturing operations and foresee the clear results in the second trimester of 2020 (Haren & Simchi-Levi., 2020). This needed resilient supply chains and out of box inventive methodologies for supply chain recuperation (Remko, 2020). The logistics system critically oversees disturbances and recuperation of supply chain (Choi, 2020). During pandemic, the food and health care equipment required resilient supply chain. In additional to this the gaps of the current worldwide supply chain were also uncovered that brought income loss and Supply un-fulfillment in COVID-19 (Tom Linton & Bindiya Vakil, 2020). The pandemic make easy to select resilient supply chain to help a contracting economy (Currie et al., 2020; Dolgui et al., 2020). The Logistics Performance Index is an intelligent instrument made to distinguish the difficulties and openings faced in performance on trade logistics and what to do for its improvement. The LPI linked with operators on the ground (global freight forwarders and express transporters), providing inputs on the logistics "agreeableness" of the nations where they work and those with which they trade.

The Logistics Performance Index in general score reflects impression of a nation's logistics performance dependent on the productivity of the customs clearance process, quality of trade and transport-related infrastructure, ease of arranging competitively priced international shipments, quality of logistics services, ability to track and trace

consignments, and frequency with which shipments reach the consignee within the scheduled time. Subtleties of the survey methodology and index development methodology are accessible in (Arvis et al., 2010) "connecting to Compete 2018: The Logistics Performance Index and Its Indicators", available at lpi.worldbank.org, see Appendix 5 for methodology (World Bank).

Research Methodology

The survey-based research was conducted which questionnaire was adapted from (World Bank LPI_2018_Questionaitre). In survey research, the researcher tried to find out the characteristics of a population under study. The current study was cross sectional, descriptive, causal and the sample size was 129 respondents by using purposive sampling project organizations.

Results and Analysis

Demographic

Table 1 shows the demographic characteristics of the129 respondents in the chosen sample. Focusing on the greater percentage of the demographic traits, 87% were males and 13% females. They are holding positions as 21% Senior Executive, 9% Area & Country manager, 19% Department Manager, 19% Supervisor, 26% operations and 6% others. Almost 100% of the respondents were employed in the private sectors and working related to 12% Maritime, 43% Road, 3% Rail, 8% Air Transport, 6% Express Delivery and 28%. Multimodal. Concerning the sectoral split of the employees working in logistics service-based businesses, the results showed that almost 100% of employees represented direction of trade and transport, 12% exports, 13% Imports, 13% Export & Imports, 22% Domestic, 2% International transit, and merely 38% respondents were most of the above. All the employees were working in main line of 20% full container/ truck load, 7% less then container / truck load, 6% bulk / break bulk cargo, 7% custom tailored logistic solution, 166% warehousing and distribution, 5% courier services and 39% most of the above.

Table 1

Demographic Characteristics of Respondents

	Frequency (N = 129)	Percentage
Gender		
Male	112	86.82%
Female	17	13.18%
Position in Company		
Senior Executive	27	20.93%
Department Manager	25	19.38%
Operations	33	25.58%
Supervisor	25	19.38%
Area and or country manager	11	8.53%
Others	8	6.20%
Typically deal with in		
Air Transport	10	7.75%
Express Delivery	8	6.20%
Maritime	16	12.40%
Multimodal	36	27.91%
Rail	4	3.10%
Road	55	42.64%
Direction of trade		
Domestic	29	22.48%
Export	15	11.63%
Export& Import	17	13.18%
Import	17	13.18%
International transit	2	1.55%
Most of the above	49	37.98%
Main line of work		
Bulk/Break Bulk cargo	8	6.20%
Courier Services	6	4.65%
Customer tailored solution	9	6.98%
Full container/ truck load	26	20.16%
Less than container/ truck load	9	6.98%
Warehousing and distribution	21	16.28%
Most of the above	50	38.76%
Total	129	100%

Descriptive

The findings of the descriptive numerical analysis encompassing standard deviation and mean values of the constructs as shown in Table 3. Mean value and standard deviation of the first variable i.e. logistics performance index were recorded as 3.6031 and 0.52039 respectively. Fear of Covid-19 was the 2nd construct with mean of 3.0594 and standard deviation value of 0.830536. The final construct Supply chain resilience showed a mean value equal to 3.8643 and Std. deviation i.e. 0.55659 which signifies that respondents have s clear and fair pictures on the study

KMO Validity

Table 3 shows the outcomes of exploratory factor analysis (EFA) steered on collected data set from domain specific participants. Based on the analysis, logistics performance index given its factor loading exhibited value less than 0.5. Consequently, the KMO value for gauging the sample's adequacy was raised to 0.874 (p-value < 0.05). For the variable, Fear of COVID-19, the recorded index of KMO test came out to be 0.843 (p < 0.05). Likewise for supply chain resilience, 6 items in total form the originally adapted measuring instrument were reduced due to their factor loadings showing values less than 0.5 and merely explaining any variance in the data-based results. Resultantly, KMO index approached to 0.773 (p < 0.05).

Reliability Analysis

Reliability analysis was conducted to determine the inter-item consistency of each of the constructs (measuring instruments) based on Cronbach's Alpha coefficients. Cronbach's Alpha findings confirmed that logistic performance construct's reliability coefficient was 0.747 as shown in Table 3. For Fear of COVID-19, the Cronbach's Alpha index was reported as 0.902. Simultaneously, the reliability Alpha value for supply chain resilience was 0.798. As the minimum required index of Cronbach's Alpha is 0.70 (Hoque & Awang, 2016), this signifies that the questionnaire was considered significantly reliable.

Correlation Analysis

Correlation analysis was directed to assess the extent and significance level of the association/relationship among all the three-variable considered for the intended research study. Based on the analysis, it was established

that Logistics Performance held a significantly positive relationship with Supply Chain Resilience with 35.0% (p < 0.01 i.e., p = 0.000). This revealed a strongly positive association of logistics performance in the supply chain resilience. Likewise, COVID-19 consisted of a significant and moderately positive relationship with logistic performance. This showed that Corona virus pandemic was up to a narrow extent was related their logistic performance having correlation magnitude of 27.5% and p-value < 0.01 i.e., p = 0.002. Contrary to this, there was established an insignificant association between the Fear of COVID-19 and supply chain resilience with inconsequential extent of 6.2% and p-value > 0.01 i.e. p = 0.483. The correlation analysis's findings have also been summated in the Table 3 displayed below:

Table 3

Correlation Analysis, Descriptive, Construct Reliability and KMO Validity

Constructs	Logistic Performance Index	COVID-19	Supply Chain Resilience
Logistic performance Index	-----		
COVID-19	27.5%**	----	
Supply chain resilience	35.0%**	06.2%	----
N	129	129	129
Mean	3.6031	3.0594	3.8643
Std. Deviation	0.52039	0.83536	0.55659
Reliability	0.747	0.902	0.798
KMO Index	0.789	0.843	0.773

Table 4

Model Fit and Significance

	Model	df	Mean Square	F	p
1	Regression	1	4.850	17.696	.000[b]
2	Regression	2	2.437	8.829	.000[c]

a. Dependent Variable: SCR

b. Predictors: (Constant), LPI

c. Predictors: (Constant), LPI, LPI_COVID

Process based Moderation Analysis

Intended research involved moderation analysis on SPSS using the 'process' technique that helped create interaction between the moderating variable 'M' i.e. Covid-19 and the independent variable 'X' i.e. Logistic performance and perform centering of the data automatically. Extracting the effects derived from the moderation analysis using process, our overall theoretical model showing all total and complete effects exhibited that logistics performance had a significantly positive effect on supply chain resilience.

Based on the results derived from "Process" technique, overall model (complete/total effect) demonstrated significant impact of logistics performance on supply chain resilience F (3, 125) = 9.2555, p < 0.05. However, the complete moderation interaction effect shows a considerable insignificant impact on supply chain resilience with p - value = 0.2110 i.e. p greater than 0.05. The study of the intended research leads toward the endorsement of H1 which says that 'Logistics performance index plays a substantial role in enhancing the supply chain resilience'. The insignificance of the moderating impact of COVID-19 in the relationship between the supply chain resilience and logistics performance indicates unsupportive H2 as it does not support the theoretical ground works. The study's findings lead us to accomplish that COVID does not regulate the supply chain resilience. The results can be seen in Table 5.

Table 5

Direct and Interaction Effects

Model = 1	Y = SCR	X = LPI	M = COVID	Sample Size = 129		
Outcome Variable: Supply Chain resilience						
Model Summary						
R	R^2	MSE	F	df1	df2	P
.4859	.2361	.2423	9.2555	3	125	.0000
Interaction Effect						
	β	SE	T	p	L Bound	U Bound
α constant	3.8236	.0468	81.7438	.0000	3.7310	3.9162
COVID	-.0720	.0572	-1.2573	.2110	-.1853	.4013
LPI	.4484	.1238	3.6208	.0004	.2033	.6935
Direction Effect of LPI on SCR						

	β	SE	T	p	Lower Bound	Upper Bound
	.3432	.0982	3.4935	.0007	.1488	.5376
Indirect Effect of LPI on SCR						
COVID	B	Boot SE	Boot LLCI		Boot ULCI	
	-.8354	.1423	-.1198*		.4433*	

* p > 0.05

Discussion

The strength of a supply chain lies within its weakest link or vice versa since logistics is considered to be the one and only segment of supply chain with integrate the whole system physically. Logistics performance index is a tool developed by World Bank, to measure the logistics performance of a nation and relate it to trade and commute (Bank., 2020). Therefore, this study aims to inquire the role of Logistic Performance Index (LPI) in Supply chain Resilience (SCR) in direct relation and along with the intervening moderating role of Corona Virus (COVID-19) during the uncertain environment. Results were deployed on the survey data accumulated from 129 employees according to a rule of 10 with a 100% response rate from different organizations in Pakistan. Cronbach's alpha was figured to intend on the reliability of the adapted instruments with 6 items, reliability index of the LPI construct (Mean = 21.61; SD = 3.133) was observed to be 0.747 while Logistics performance index with six indicators (customs, infrastructure, Tracking and tracing, ease of shipment, logistics service quality and timelines) adapted from (Bank., 2020). Alpha reliability index of the COVID (Mean = 18.36; SD = 5.012) was verified to be 0.902. Supply chain resilience with 6 items reported 0.798 Cronbach's reliability (Mean = 23.19; SD = 3.340). The following results of all items of variables verified by using Kaiser-Meyer-Olkin (factor analysis) as it ascertains the level of common variance. Moving to the demographic traits, it can be found that out of 129 respondents, 87% were males, with 13% females. Holding positions 21% Senior Executive, 9% Area & Country manager, 19% Department Manager, 19% Supervisor, 26% operations and 6% others. Almost 100% of the respondents were employed in the private sectors and working related to 12% Maritime, 43% Road, 3% Rail, 8% Air Transport, 6% Express Delivery and 28%. Multimodal. Concerning the sectoral split of the employees working in logistics service-based businesses, the results

showed that almost 100% of employees represented direction of trade and transport, 12% exports, 13% Imports, 13% Export & Imports, 22% Domestic, 2% International transit, and merely 38% respondents were most of the above. All the employees were working in main line of 20% full container/ truck load, 7% less then container / truck load, 6% bulk / break bulk cargo, 7% custom tailored logistic solution, 166% warehousing and distribution, 5% courier services and 39% most of the above.

The relationship between logistics performance and supply chain resilience has appeared as an ongoing debate between practitioners and researchers. The role of logistics performance is considerable in strengthen the supply chain. In particular, according to the H1 hypothesis, Logistics performance was found to have a significantly positive correlation with supply chain resilience (p-value < 0.01) as shown in Table 4 & 5. On the other hand, COVID has observed insignificant and negative relationships with SCR (p < 0.01) as shown in Table 5. Hence, regression analysis involved determining the degree of logistics performance with β coefficient equal to .350 having significance value sinking below 0.05 (β = .350, p < 0.05).

The results derived from the "Process (Hayes Process)" technique and overall model (complete/total effect) reflected that significant impact of logistics performance on supply chain resilience $F_{(3, 125)}$ = 9.2555, p < 0.05 while the complete moderation interaction effect shows a considerable insignificant impact on supply chain resilience with p - value = 0.2110 i.e. p greater than 0.05. The following indications from the analysis showed that the H1 hypothesis supported, While the H2 hypothesis was not supported because the insignificance of the moderating impact of COVID in the relationship between logistics performance and supply chain resilience.(please discuss your results based on recent researches)

Conclusion

Among the other supply chain management paradigms, green, lean, and resilient are viewed as basic to supply chain (Azevedo et al., 2008; Carvalho et al., 2012). This study explored the role of logistics performance in enhancing resilience of supply chain. A strong relationship exists between the logistics performance and supply chain resilience. The LPI studied

already give knowledge about logistics situations in nations (Ekici et al., 2016; Jumadi & Zailani, 2010). The study of the intended research leads toward the endorsement of H1 which says that 'Logistics performance index plays a substantial role in enhancing the supply chain resilience'. Yet, insignificant effect of COVID on the relationship between Logistics performance and supply chain resilience has been witnessed in this research and indicates unsupportive H2 as it does not support the theoretical ground works.

Future Recommendations and Contribution

This study showed that the role of the logistics performance in resilience of supply chain. Numerous different studies utilized LPI and its various parts for other exploration purposes (Hoekman & Nicita, 2011). The LPI is utilized as an impression of logistics performance that can be affected by certain strategy measures. Similarly different other segments of supply chain like supplier, supplies, warehousing, inventory, transformation and other should be studied and bought under research for measuring their role for resilient supply chain. Meanwhile, these following results indicated in terms of logistics performance indicators ought to be used as maximally to obtain robustness and resilient supply chain. Therefore, different private and public sectors should be advised mangers to use logistic performance indicators to enhance the strength of supply chain. Further research may investigate the resilience of the supply chain among other phenomena's as moderating effects. Certain control variables such as gender, working group or type of industrial sector can be considered on account of future research to empirically analyze if supply chain resilience.

Limitations

This study was conducted and concluded in the systematic way, however there are some limitations were also being faced during the time. One of the research variables COVID has become the limitation as due to preventive behaviors of organizations "work from home" limited human resource were available to respond the physical survey form. Therefore, E-survey forms was developed on Google doc and then distributed to the domain specific people, which remained the researchers with limited data as compared to the initially targeted. Another limitation was time

constraint to complete the survey and research before the second wave of COVID hit and cease the day-to-day life, in form of complete or partial lockdown.

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